INE INSTITUTE OF NUTRITIONAL ENDOCRINOLOGY

Micronutrients: Vitamin A

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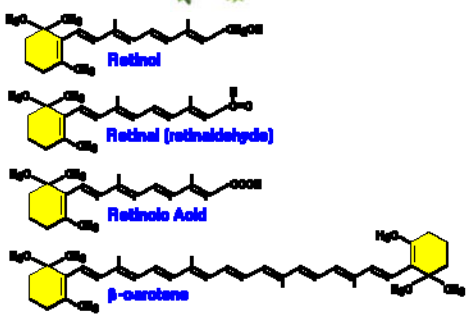
Medical Disclaimer: The information in this presentation is not intended to replace a one-on-one relationship with a qualified health care professional and is not intended as medical advice. It is intended as a sharing of knowledge and information from the research and experience of Dr. Ritamarie Loscalzo, drritamarie.com, and the experts who have contributed. We encourage you to make your own health care decisions based upon your research and in partnership with a qualified health care professional.

Vitamin A

Fat soluble vitamin – actually a group of compounds, that includes:

- Retinol
- Retinal
- Retinoic acid
- Provitamin A carotenoids
  - Beta-carotene
  - Alpha-carotene
  - Gamma-carotene
  - Lutein
  - Lycopene
  - Zeaxanthin

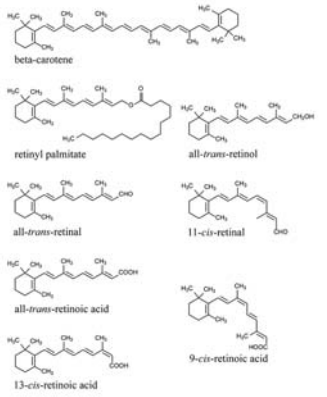
Vitamin Structure



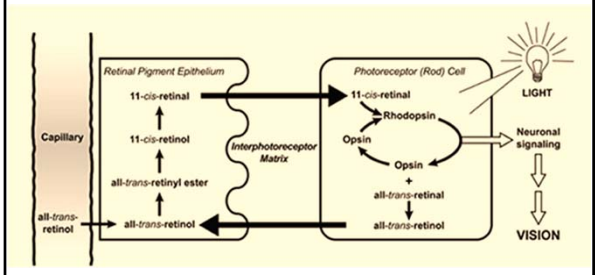
Main Functions of Vitamin

- ✓ Vision
- ✓ Gene transcription
- ✓ Embryonic development and reproduction
- ✓ Hematopoiesis
- ✓ Protein synthesis
- ✓ Cell-differentiation
- ✓ Integrity of skin and epithelial tissues
- ✓ Immune function
- ✓ Bone metabolism
- ✓ Antioxidant activity

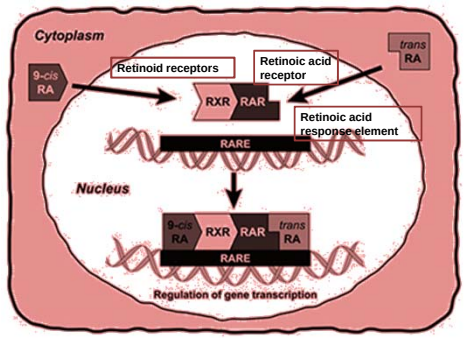
Vitamin Chemical Structure



Vitamin A and Vision



Vitamin A and Gene Transcription



Vitamin A and Immunity

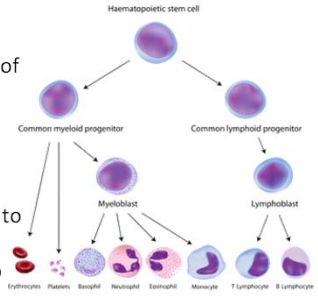
- ✓ Retinoic acid produced by antigen-presenting cells (APCs), including macrophages and dendritic cells
- ✓ Retinoic acid acts on dendritic cells to regulate differentiation, migration, and APC
- ✓ Retinoic acid required for differentiation of naïve CD4 T-lymphocytes into regulatory T- lymphocytes
- ✓ All-trans-RA/RARα signaling promotes conversion of naïve CD4 T-lymphocytes into effector helper T-cells (Th1) and induces proinflammatory cytokines
- ✓ Vitamin A may play a role in autoimmunity

Embryonic Development And Reproduction

- ✓ Both vitamin A excess and deficiency are known to cause birth defects.
- ✓ Retinoic acid is critical for development of heart, eyes, ears, lungs, limbs, and visceral organs.
- ✓ Vitamin A has been implicated in fetal lung maturation - lower in preterm newborns.
- ✓ Supplementation may help reduce incidence of chronic lung disease and mortality in preterm newborns.

Hematopoiesis

- ✓ A role in stem cell commitment and differentiation
- ✓ Regulates apoptosis (programmed cell death) of red blood cell precursors
- ✓ Increases hemoglobin concentration
- ✓ Facilitates mobilization of iron from storage sites to the developing red blood cell for incorporation into hemoglobin



Vitamin A Deficiency and Thyroid

- ✓ Increases TSH
- ✓ Increases the size of the thyroid gland
- ✓ Reduces iodine uptake by the thyroid gland
- ✓ Impairs the synthesis and iodination of thyroglobulin
- ✓ Increases circulating concentrations of thyroid hormones

Nutrient Interactions: Vitamin A and Zinc

- ✓ Zinc deficiency results in decreased synthesis of retinol-binding protein, which transports retinol to peripheral tissues and protects against potential toxicity of retinol
- ✓ Zinc deficiency results in decreased activity of retinyl palmitate, the enzyme that releases retinol from its storage form
- ✓ Zinc is required for the enzyme that converts retinol into retinal

Nutrient Interactions: Vitamin A and Iron

- ✓ Vitamin A deficiency may exacerbate iron deficiency anemia by altering iron metabolism
- ✓ Vitamin A improves iron status among children and pregnant women
- ✓ Vitamin A and iron together seem to reduce anemia more effectively than either alone
- ✓ Studies in rats: iron deficiency alters plasma and liver levels of vitamin A

Deficiency of Vitamin

- ✓ Night blindness (nyctalopia)
- ✓ Blindness
- ✓ Keratomalacia: softening of the cornea
- ✓ Xerosis: dry skin
- ✓ Rough/dry skin
- ✓ Reduced sense of smell
- ✓ Fatigue
- ✓ Keratinization: skin becomes hard, dry, rough and scaly due to secreting in keratin

Recommended Daily Allowance (RDA) of Vitamin

- ✓3,000 IU per day for men
- ✓2,300 IU per day for women
- ✓2,600 IU per day for pregnant women 19 years and older
- ✓4,300 IU per day for lactating women 19 years and older

Carotenoids

- ✓Precursors to vitamin A
- ✓Antioxidant activity of their own
- ✓Protect the eye
- ✓Two classes: carotenes (α-carotene, β-carotene, and lycopene) and xanthophylls (β-cryptoxanthin, lutein, and zeaxanthin)
- ✓Lutein, lycopene, and zeaxanthin cannot be converted to retinol, so they have no vitamin A activity

Toxicity/Excess of Vitamin

- ✓High intake of vitamin A may accumulate in the liver and build up to toxic levels
- ✓Children are the most sensitive
- ✓Excess worse for smokers (based on controversial testing)
- ✓May lead to birth defects
- ✓Signs of toxicity may include: nausea, coarse hair, loss of hair, dry/scaling skin, fatigue, blurry vision, drowsiness, enlarged liver, headaches, bone pain

Sources

Vitamin A as retinol (animal sources) and carotene (vegetable sources) from highest to lowest

Highest

- ✓ Liver
- ✓ Peppers, red chili
- ✓ Dandelion greens
- ✓ Sea buckthorn fruit
- ✓ Pomegranate
- ✓ Carrot
- ✓ Apricot, dried
- ✓ Collared leaves
- ✓ Kale
- ✓ Sweet potato
- ✓ Parsley
- ✓ Spinach
- ✓ Turnip greens
- ✓ Mustard greens
- ✓ Swiss chard
- ✓ Beet greens
- ✓ Chives
- ✓ Butternut squash
- ✓ Watercress
- ✓ Mango
- ✓ Peppers, sweet red
- ✓ Hubbard squash
- ✓ Cantaloupe
- ✓ Endive
- ✓ Apricot
- ✓ Broccoli spears
- ✓ Whitefish
- ✓ Green onion
- ✓ Romaine lettuce
- ✓ Papaya
- ✓ Nectarine
- ✓ Prunes
- ✓ Pumpkin
- ✓ Swordfish
- ✓ Peaches
- ✓ Acorn squash
- ✓ Eggs
- ✓ Chicken
- ✓ Cherry , sour red
- ✓ Butterhead lettuce
- ✓ Asparagus
- ✓ Tomato, ripe
- ✓ Chili pepper
- ✓ Kidney
- ✓ Peas
- ✓ Green bean
- ✓ Elderberry
- ✓ Watermelon
- ✓ Brussels sprouts
- ✓ Cornmeal

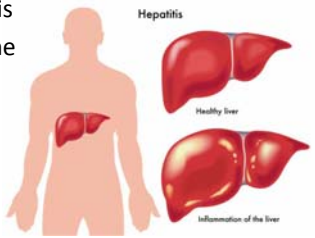
Lowest

World's Healthiest Foods ranked as quality sources of vitamin A

Food	Serving Size	Cals	Amount (mcg RAE)	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
Sweet Potato	1 medium	180.0	1921.80	213.53	21.4	excellent
Carrots	1 cup	50.0	1019.07	113.23	40.7	excellent
Spinach	1 cup	41.4	943.29	104.81	45.6	excellent
Kale	1 cup	36.4	885.36	98.37	48.6	excellent
Mustard Greens	1 cup	36.4	865.90	96.21	47.6	excellent
Collard Greens	1 cup	62.7	722.00	80.22	23.0	excellent
Turnip Greens	1 cup	28.8	549.00	61.00	38.1	excellent
Swiss Chard	1 cup	35.0	535.85	59.54	30.6	excellent
Winter Squash	1 cup	75.8	535.36	59.48	14.1	excellent
Romaine Lettuce	2 cups	16.0	409.37	45.49	51.2	excellent
Bok Choy	1 cup	20.4	361.16	40.13	35.4	excellent
Cantaloupe	1 cup	54.4	270.56	30.06	9.9	excellent
Bell Peppers	1 cup	28.5	144.03	16.00	10.1	excellent
Parsley	0.50 cup	10.9	128.04	14.23	23.4	excellent
Broccoli	1 cup	54.6	120.74	13.42	4.4	very good

Vitamin A and Infectious Disease

- ✓ High doses for Hepatitis
- ✓ Deficiency increases the risk of:
  - ➢ Pneumonia
  - ➢ Severe diarrhea
  - ➢ Measles
  - ➢ Malaria
  - ➢ …and a variety of other infections



Therapeutic Uses Of Vitamin A

- ✓Infections disease
- ✓Hepatitis
- ✓Leaky gut repair
- ✓Acne
- ✓Restoring night vision
- ✓Eczema

Forms of Vitamin A Supplements

- ✓Synthetic: Acetate and Palmitate
- ✓Natural source: Animal derived – derived from fish liver oil
- ✓Mycelized liquid
- ✓Capsules: Soft gels
- ✓Cod liver oil